ECE 835: Electromagnetic Fields and Waves I
Fall 2013;

Instructors: Prof. Shanker Balasubramaniam
email: bshanker@egr.msu.edu
Office Hours: By appointment–typically Tuesday and Thursday.
Recommended Text: Time Harmonic Fields, R. F. Harrington
Suggested Books:

1. J. Stratton, Electromagnetic Theory, McGrawHill.
2. A. Ishimaru, Electromagnetic wave propagation and scattering, Prentice-Hall.
3. J. A. Kong, Electromagnetic Wave Theory, John Wiley and Sons.
4. J. D. Jackson, Classical Electrodynamics, John Wiley and Sons.
5. C. A. Balanis, Advanced Engineering Electromagnetics, John Wiley and Sons.

Class Policies

1. **Homework** Approximately 7-8 homework assignments will be given.
2. **Grade Distribution**
   - Homework: 15%
   - Exam (3): (20 + 20 + 35) 75%
   - Final Oral: 10%

Tentative Course Outline:

1. Review of Vector Calculus
2. Fundamental Concepts
   (a) Basic equations
   (b) Constitutive relations
   (c) Generalized current
   (d) Energy and power
   (e) Complex quantities
   (f) Constitutive parameters
   (g) Complex power
   (h) A-C characteristics of matter
   (i) A discussion of current
   (j) Singularities of the field
3. Introduction to waves
   (a) The wave equation
   (b) Waves in perfect dielectrics

(c) Intrinsic wave constants
(d) Waves in lossy matter
(e) Reflection of waves
(f) Transmission line concepts
(g) Waveguide concepts
(h) Resonators concepts
(i) Radiation
(j) Antenna concepts
(k) On waves in general

4. Some theorems and concepts

(a) The source concept
(b) Duality
(c) Uniqueness
(d) Image theory
(e) The equivalence principle
(f) Fields in half-space
(g) The induction theorem
(h) Reciprocity
(i) Green's function
(j) Tensor Green's function
(k) Integral equations
(l) Construction of solutions
(m) Radiated field

5. Plane wave functions

(a) The wave functions
(b) Plane waves
(c) The rectangular waveguide
(d) Alternative mode sets
(e) Partially filled waveguide
(f) Dielectric slab waveguide
(g) Surface guided waves
(h) Modal expansions of fields
(i) Currents in waveguides
(j) Apertures in ground planes
(k) Plane current sheets